Development of Flipbook-Type E-Modules Based on Stunting Case Studies to Improve Concept Mastery on Digestive System Materials

Windy Oktaviani[1], Margaretha Solang[1], Masra Latjompoh[1*]

[1] Department of Biology, Faculty of Mathematics and Natural Sciences, Gorontalo State University, Gorontalo, Indonesia.

Abstract: The study aims to describe the validity, practicality and determine the effectiveness of flipbook-type e-modules based on stunting case studies to improve the concept mastery on digestive system material. This research uses research and development methods modified. Data collection techniques using observation sheets, questionnaires and tests. The trial was conducted on 37 students of Class XI IPA 2 SMA Negeri 1 Kabila. The research results found: (1) validity tests is in "Very Good" category based on the percentage of content/material validation of 87.50% and construction validation of 98.00% (2) practicality test is in "Very Good" category based on the percentage of learning implementation of 92.63%, student activity of 90.22%, teachers responded of 96.00%, and students response of 98.96% (3) effectiveness test based on the results of small group N-Gain score analysis worth of 0.70 (Effective). Based on the results of the research, it can be concluded that the flipbook-type e-module based on stunting case studies to improve concept mastery on digestive system material meets the valid, practical and effective criteria so that it is suitable for use in Biology learning to improves students concept mastery on digestive system material at SMA Negeri 1 Kabila.

Keywords: Case Studies; Digestive System; E-Module; Stunting

Introduction

Bioprocess is a process that uses living organisms or microorganisms (bacteria, hamsters, fungi) or their components (enzymes, chloroplasts) to produce a desired product (Istianah et al., 2018). In the food digestive system, bioprocesses that occur, for example, in the use of protease enzymes that function in modifying the structure of food (Zhang et al., 2018). Bioprocesses occur inside the body but the processes cannot be seen realistically so the concept of bioprocesses that occur in the digestive system is one of the abstract concepts (Aulia et al., 2020).

Bioprocess materials are taught in biology subjects in class XI on the basic competence 3.7 namely to analyze the relationship between the structure of organ composing tissue in the digestive system in relation to nutrition, bioprocesses and dysfunction that may occur in the human digestif system. Based on the results of

observations and interviews at the SMA Negeri 1 Kabila school, learning on digestive system material is still less discussed about bioprocesses. In addition, the teaching materials used on the material of the digestive system are still in the form of printed books and student worksheets.

Teachers as facilitators should be able to develop the teaching materials used. One type of teaching materials that can be develop by teachers is the learning module. The time limit in the classroom can be met through the learning process with the help of the learning module so that it can be done by each student independently to meet the learning objectives (Puspita, 2019). Along with the development of existing technology, printed modules can be converted into the form of electronic modules. The advantages of the e-module can be seen in the aspect of flexibility that allows the use of e-modules in unspecified conditions and times (Wijaya et al., 2022). Media or facilities are needed in the

development of interactive e-modules in order to produce good and interesting modules. One of the media that can be used is the flipbook. According to Wijaya et al. (2021) the flipbook animation effect when switching pages can make students read by feeling like they open a book physically.

Given that the biological learning content is closely related to the aspects of life and the environment around the students, then for the development of the media form e-module can use case study-based methods. Case study-based learning is one of the student-centered learning models that utilizes real-life situations to be discussed in small groups so that students can associate problems that occur in real life with concepts that are taught (Plasencia, 2023). One of the cases that can be presented in biology learning is the case of stunting. Stunting is a condition in which children under the age of 5 fail to grow due to chronic malnutrition, which results in children becoming too short for their age (Wati et al., 2021)

Overcoming stunting is not only the responsibility of the government, but also of various parties including education. Schools as one of the educational institutions can be a suitable means to educate students, especially students in adolescence by the understanding and ability of students related to the needs of healthy living and how to choose nutritious food. This is in line with the opinion of Rusilanti & Riska (2021) which argues that nutrition education for adolescents is expected to play a role in raising awareness in adolescents who will be future parents against the health of mothers and children, including to break the chain of the cycle of stunting issues.

Nutrition education using flipbook-type e-modules based on case study of stunting contains information about stunting problems, food substances needed by the body, balanced food menu as well as how to maintain self-health which is integrated into the basic competencies taught in schools related to bioprocesses on the digestive system so that it can enhance nutritional knowledge in adolescents. This is expected to improve students' mastery of concept by connecting concepts that have been learned with real cases by using valid, practical and effective teaching materials.

Method

This research was conducted in the odd semester of the 2022/2023 school year in Class XI IPA 2 SMA Negeri 1 Kabila. This research uses research and development methods modified from Sugiyono (2018). The research was conducted only until the stage of a limited scale trial. This research uses the one-group pretest-posttest design. The research instruments used in this study are validation sheets, learning implementation questionnaires, student activity observation sheets, user response questionnaires (teachers and students), and learning outcome tests.

Validity Analysis

Scoring e-module validation using the Likert scale with a score range of 1-4. Data analysis using formula:

$$\text{Validity} = \frac{Total\ Score\ of\ All\ Validators}{\Sigma The\ Highest\ Score}\ x\ 100\% \qquad (1)$$

The results of the validity analysis are then interpreted in the following Likert scale categories

Table 1. Score of the Likert Scale

Category	Score
Very Valid	86-100
Valid	71-85
Valid Enough	56-70
Less Valid	41-55
Invalid	≤ 40

(Source: Yazid et al., 2016)

Practicality Analysis

Practicality data is obtained through learning implementation questionnaire, student activity observation sheets and user response questionnaire (teacher and students). The learning implementation questionnaire uses a score of 1-4 with the following formula:

$$\text{Implementation of learning} = \frac{\Sigma Score\ every\ aspect.}{\Sigma Maximum\ score}\ x\ 100\% \qquad (2)$$

The conclusion of the data analysis is adjusted to the criteria for the percentage of the average score of the results of the learnings implementation sheet.

Table 2. Assessment of Learning Implementation

Score	Category
81-100	Very Good
61-80	Good
41-60	Enough
21-40	Less
0-20	Sangat Kurang

(Source: Yazid et al., 2016)

Student activity is assessed using a questionnaire with a score scale of 1 to 4. The formula used to calculate student activity:

$$\text{Students activity} = \frac{\Sigma Score\ every\ aspect.}{\Sigma Maximum\ score}\ x\ 100\% \qquad (3)$$

The conclusion of data analysis is adjusted to the student activity assessment category which can be seen in Table 3.

Table 3. Student Activity Assessment Categories

Score	Categories
0-20	Very Less
21-40	Less
41-60	Enough
61-80	Good
81-100	Very good

(Source: Yazid et al., 2016)

Analysis of User Responses

User responses are teachers and students. Teacher response uses a rating scale of 1-4. Students' response using a questionnaire with the answer "Yes" "No". The result of the calculation of the user response questionnaire interpreted into the following criteria:

Table 4. Interpretation of User Response Score

Criteria	Score (%)
Very Less	0 – 20
Less	21 – 40
Simply	41 – 60
Good	61 – 80
Very Good	81 – 100

(Source: Riduwan, 2012)

Analysis of Learning Outcome Test

The students' learning outcomes referred to in this study are scores obtained from the learning outcomes test given after learning activities with the following formula:

$$\text{Learning Outcome} = \frac{Sum\ of\ Scores}{Maximum\ Score} \ x\ 100\% \qquad (4)$$

Then to calculate the percentage of accuracy of the student's learning outcomes classically with the formula:

$$\text{P} = \frac{Number\ of\ students\ who\ are\ complete}{Total\ number\ of\ students} \ x\ 100\% \qquad (5)$$

The percentage result obtained after calculating using the formula are then adjusted to the criteria as follows:

Seeing the effectiveness of e-modules is calculated using the N-gain formula (Normalized gain) with the following criteria:

Table 5. Learning Outcome Test Effectiveness Criteria

Percentage	Criteria
> 80	Very effective
> 60-80	Effective
> 40-60	Effective Enough
> 20-40	Less effective
≤ 20	Ineffective

(Ramdayani et al., 2021)

Table 6. Normalized Gain Category

Normalized Gain Score	Category
0.70 ≤ Normalized Gain	High
0.30 ≤ Normalized Gain < 0.70	Medium
Normalized Gain < 0.3	Low

(Source: Mursali, 2015)

Result and Discussion

Based on the research that has been conducted, the following results were obtained:

Validity

The validity of the e-module consists of two aspects: content/material validity and construct validity. The content feasibility aspects by expert material validators obtain a percentage of 75%, the presentation component aspects obtain a percentage of 100%, the language aspects obtain a percentage of 75% percent, and case study-based e-module aspects obtained a percentage of 100%. The ratings of the 4 aspects was averaged to obtain 87.5% with the criteria "Very Valid". This indicates that e-module produced can be used for the learning process in terms of the content/material assessment.
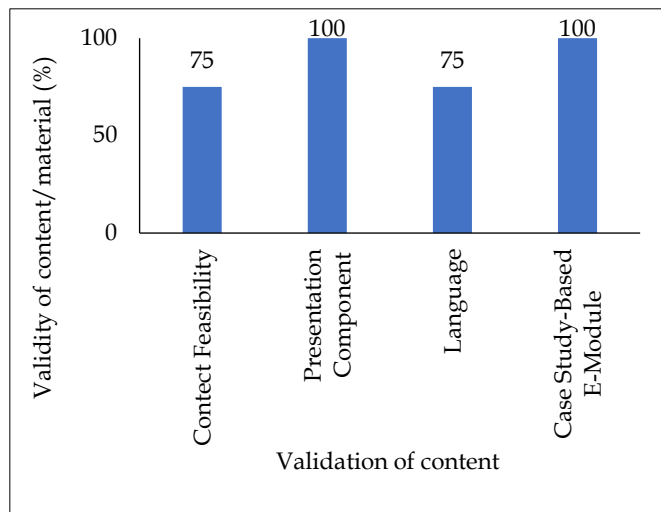

Figure 1. Percentage of Content/Material Validation Results

Construct validation assessments on text message design aspects obtain 96%, image message design obtain 100%, audio message design get 100%, video message design gets 100%, and e-module organization obtains 100%. The ratings of the five aspects grouped obtained 98% with the criterion "Very Valid".
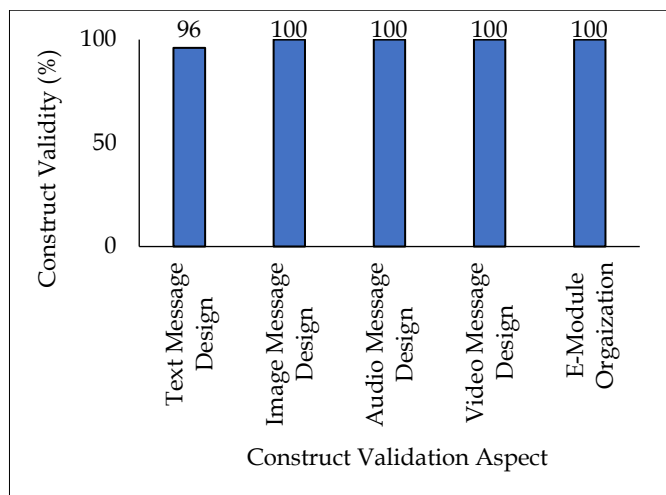
Figure 2. Percentage of Construct Validation Results

Validity of content and validity of construction by expert validator after the product review obtained an average percentage of 87-100% on each aspect observed with criteria so valid that it can be used in the learning process to improve the mastery of concepts on the material of the digestive system. This is in line with the research carried out by Aprilia & Wulandari (2022) which stated that the validity criteria of data raised validator assessment with a percentage >81% is included in the criteria very valid.

After stated that the e-module developed is very valid to improve the mastery of the concepts of the learners on the material of the digestive system, the further e-module based on the study of the case of stunting is tested limited in the learning process to know the practicality and effectiveness of the e-module developed to enhance the Mastery of concepts on the materials of the Digestive System. According to Zukmadini et al. (2022) after the e-module is validated in terms of its material and teaching materials, then to know its practicality and effectiveness, the module can be tested on a limited scale.

Practicality

The practicality of the flipbook-type e-module based on the case study of stunting to improve the mastery of concepts on the material of the digestive system is seen from the value of the well-performed learning activities, the increased activity of students in the classroom, as well as how teachers and learners respond to the e-module developed. According to Agung et al. (2021) If the product developed can be applied in the field, respondents are interested in using the product for learning, and respondents easily understand the learning material then the product development results can be said to be practical.

Table 7. Percentage of Learning Performance

Meeting	Percentage (%)	Average (%)
Meeting I	88.46	
Meeting II	93.27	92.63
Meeting III	96.15	

A performance assessment is said to be successful when the value obtained in the category is good and excellent. The results of the implementation of learning according to the recapitulation carried out in Class XI IPA 2 during the three meetings each obtained the results of meeting I 88.46%, meeting II 93.27% and meeting III 96.15% with a percentage of implementation 81-100% of the category is very good, so implementation learning is said to be practical because it has a very good category in the meaning of learning activities using e-modules based on case studies stunting to improve the mastery of concepts on the material of the digestive system. This is in line with the results of the research carried out by Hakim et al., (2020) a learning implementation rate of 81.5% was included in a highly practical criterion that indicates that each learning phase at each meeting went well.
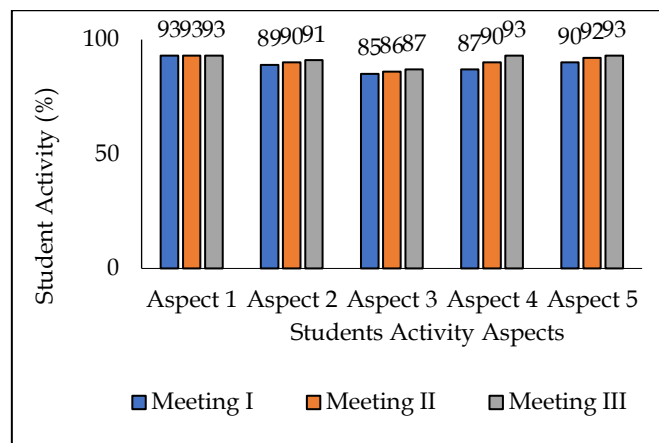

Figure 3. Student Activity

Description:
Aspect 1: Identifying the case
Aspect 2: Analysis of Problems
Aspect 3: Looking for information and taking steps to solve it
Aspect 4: Make a Conclusion
Aspect 5: Presentation

Based on the results of the observational evaluation of the student activity during the learning process, there was an increase in the student's learning activity by using the flipbook-type e-module based on case studies in each of the three meetings, namely meeting I 88.95%, meeting II 90.39%, meeting III 91.32% then arranged to 90.22% with the criterion "Very Good". Before students use the case-based e-module, the teacher first introduces the e-module and demonstrates how to use it which can

be seen in Figure 4. The student's activity based on case-based learning steps improves at each meeting that shows the student is active in following learning activities to investigate and solve real problems. This is in line with the research carried out by Arianto & Fauziyah (2020) which states that case-based learning makes students more active in discussing solving the variety of real cases given in the materials studied. According to Warjo et al. (2019) There is an activity of influencing each other and contributing thoughts when students interact with each other.

Figure 4. Introducing E-Modules to Students

The participant's activity on aspect 1, namely identifying the case on three meetings, earned a 93% percentage and an average score of 4 with the criterion "Very Good". At the stage of identifying the case, learners are presented with discourse and videos about the problem of stunting. Students identify cases through the discourse in the e-module can be seen in Figure 5. According to Dayu et al., (2022) at the stage of identifying the case, the case chosen is in accordance with the material and the aim to develop students' inquiry and discussion skills.

Figure 5. Students Identify Cases

The activity of students in aspect 2, namely analyzing problems, has increased at each meeting, namely meeting I 89%, meeting II 90% and meeting III 91%. The purpose of case-based learning is to analyze and solve problems encountered to achieve predetermined competencies (Arundhati et al., 2019). At the stage of analyzing the problem, students discuss the case in groups. Students discuss problems in groups as

shown in Figure 6. After students identify the questions in the case presented, the next step is to analyze the problem. Students formulate the problem by optimizing their prior knowledge by recalling concepts related to the problem discussed (Dayu et al., 2022). Students must move from learning that is done theoretically to a more applicable learning process, besides that student must be able to explain social phenomena in a scientific framework by applying scientific understanding (Fadilah et al., 2022).

Figure 6. Student Discuss Problems in Groups

Aspect 3 of student activity, namely finding information and making solution steps, has increased at meeting I 85%, meeting II 86% and meeting III 87%. At this stage, students seek information from various sources regarding problem solving steps, information can be obtained by answering questions on the student worksheet. Students answer questions on student worksheets can be seen in Figure 7. According to Warjo et al., (2019) students are expected to actively search for the information needed to get the solution to the problem in order to solve the problem. The process of discovery and problem solving can invite students to play an active role in the learning process. After students find the appropriate data, information and literature, students then determine the steps for solving the case presented. In line with research conducted by Muaffiani et al. (2022) Assignments in case-based learning are very beneficial for students because they can explore and develop information to find solutions to real-life cases.
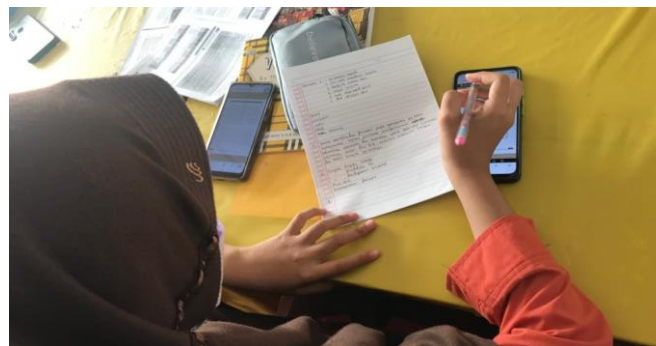

Figure 7. Student Finding Information and Making Solution Steps

Aspect 4 of student activity, namely making conclusions, has increased at each meeting. At meeting I obtained a percentage of 87%, meeting II 90% and meeting III 93%. At the conclusion drawing stage, students are expected to be able to compare, explain, and show causal interactions to reach the correct conclusion by being able to think logically or rationally (Dayu et al., 2022). In line with the research conducted by Fadilah et al., (2022), the ability of students to make conclusions using case-based student worksheets that are still low is thought to be caused by students who have not been able to manage time properly so that they have not been able to complete case-based learning until the last stage. Furthermore, in the last aspect, the percentage has increased at each meeting, namely meeting I 87%, meeting III 90% and meeting III 93%. Students presenting the results of the discussion can be seen in Figure 8.

Figure 8. Student Presentations

Practicality is also seen from the results of user responses (teachers and students) to the use of flipbook-type e-modules based on stunting case studies to improve concept mastery on digestive system material. The percentage of teacher responses is 96% with "Very Good" criteria. The teacher's response to the display aspect obtained a percentage of 100%, the content/material aspect obtained a percentage of 100%, the usage aspect obtained a percentage of 88% and the benefit aspect obtained a percentage of 96%. The average percentage of teacher response is 96% with the criteria "Very Good". In line with research conducted by Natalia (2021)the results showed that the teacher's response to the practicality of the case study-based biology learning module obtained a percentage of 87.5% and the student's response obtained a percentage of 86.61% with very practical criteria. This shows that the study-based biology learning module is easy to use which can be seen from the module's ability to help and facilitate the teacher in providing a correct explanation of the concepts learned.
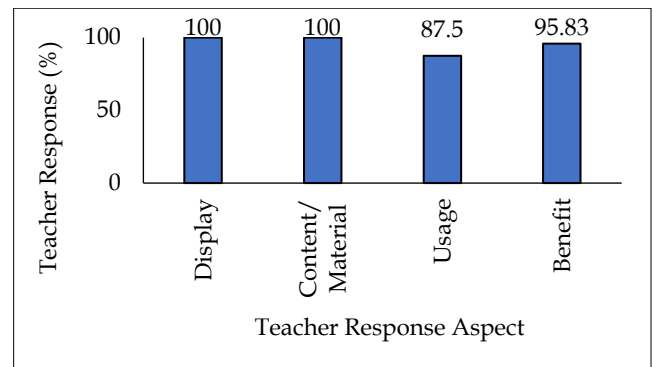

Figure 9. Results of Teacher Response Questionnaire Analysis

Learners' responses were analyzed through the results of a questionnaire given after students had actually finished using the e-module in three meetings. The percentage of learner responses is 96.36% with "Very Good" criteria from 37 learners who give a positive value to the flipbook-type e-module based on stunting case studies. This is in line with research conducted by (Hastiningrum, 2020) which shows the results of user response of 89.7% including in the "very practical" category. Research conducted by Saftina et al., (2021) The results showed that the responses given by students to teaching materials based on the case study method included a very feasible category with a percentage of 95%. Broadly speaking, respondents were happy to use the e-module, and the e-module could be used with little revision.
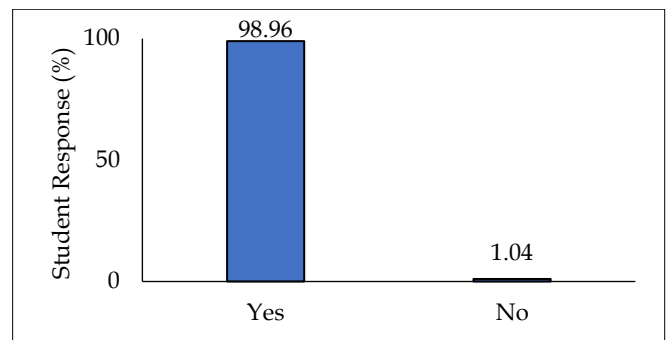

Figure 10. Student Response

The results of teacher and learner responses to the flipbook-type e-module based on stunting case studies are practical and very helpful for improving concept mastery on digestive system material because the e-module is attractive by including images, videos, and audio messages related to stunting problems that occur and are equipped with assignments in the e-module that refer to case study activities. According to Suryani & Saparuddin (2022) students become enthusiastic and more active during the learning process can occur because the images in the e-module are communicative, thus helping students in constructing the knowledge they get.

Effectiveness

The last stage is to see the effectiveness of the developed e-module. Effectiveness serves to see the success or achievement of learning by using e-modules based on stunting case studies to improve concept mastery on digestive system material. According to Subkhi et al. (2020) if the learning process goes well, then the learning outcomes will be effective and the learning objectives will be achieved. Effective learning is learning that provides opportunities for students to be able to learn or do activities independently. In addition, learning is also declared effective if students experience new experiences so that their behavior changes towards the expected accumulation point.

The effectiveness of flipbook-type e-modules based on stunting case studies to improve concept mastery on digestive system material developed can be seen through pretest scores before learning activities and posttests after completing learning using e-modules. The test given is a multiple choice test of 15 numbers and an essay test of 4 numbers. The percentage of completeness of students in pretest activities is 100% of students are not complete, while the percentage of completeness on the posttest is 76% complete with the category "Effective". In line with research conducted by Nurhidayah et al. (2021) which shows the percentage of learning outcomes test scores in the 61-80 score range with a value of 68.75% is categorized as effective. This means that the e-module developed meets the criteria for effective use in the learning process.
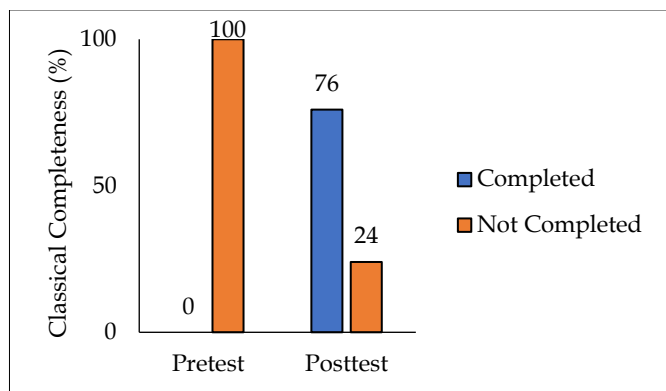

Figure 11. Classical Completeness

The average value of students in pretest activities is 30 so that it is declared incomplete because it is below the minimum completeness of biology subjects applied at SMA Negeri 1 Kabila school, namely 75. The average value of students in posttest activities has increased, namely 78.92 with a complete category. This is in line with research conducted by Awwalina & Indana (2022) which states that there is an increase in the value of students on the posttest and becomes complete or according to and more than the KKM value after using

the interactive e-module. This shows that interactive e-modules can effectively improve concept mastery on digestive system material.

The low pretest results indicate that the mastery of the concept of students on digestive system material is still at a low level, while the posttest results show very good results. This shows that there is an increase in the mastery of the concept of students. Good posttest scores are also due to students who have been able to adjust to the use of flipbook-type e-modules based on stunting case studies so that students can understand the material and be able to master the concepts on digestive system material. According to Wulandari et al. (2020) There are several factors that affect the level of mastery of students' concepts after learning, one of which is the concentration of students when participating in the learning process. If the concentration of students is low, it can affect the seriousness of learning and reduce the mastery of the material. Learners can be said to have mastered a concept if they really understand the concept that has been learned which can be shown by the ability to explain using their own words based on their knowledge without changing the meaning in it (Mardiyah et al., 2020). This shows that the use of e-modules can affect students' concept mastery in understanding the meaning of learning and applying it in everyday life.

Table 8. N-Gain Analysis Results

	N	Min	Max	Mean	Std. Deviation
Ngain score	37	50	.85	.7002	.098
Ngain persen	37	50.00	85.06	70.02	9.8
Valid N	37				

The improvement in student learning outcomes by giving pre-test and post-test can be seen through the analysis of N-gain calculations. The N-gain score obtained by students on the material of the digestive system is 0.70 with the category "High", while the percentage N-gain value (%) is 70% with the N-gain interpretation category "Quite Effective" (56-75). In line with research conducted by Rojikin et al. (2022) The results of the N-gain analysis after learning using the e-module resulted in an N-gain value of 0.71 with a high category. This shows that students can answer the learning outcomes test after learning using the e-module correctly.

Conclusion

Based on the results of the research and discussion, it can be concluded that flipbook-type e-modules based

on stunting case studies material meets the valid, practical and effective criteria so that it is suitable for use in Biology learning to improves students concept mastery on digestive system material.

Author Contributions
Conceptualization, Margaretha Solang and Masra Latjompoh.; data curation, Windy Oktaviani.; formal analysis, Windy Oktaviani.; funding acquisition, Masra Latjompoh and Windy Oktaviani.; investigation, Windy Oktaviani; methodology, Masra Latjompoh and Margaretha Solang.; project administration, Margaretha Solang and Masra Latjompoh.; software, Windy Oktaviani.; supervision, Margaretha Solang and Masra Latjompoh.; validation, Margaretha Solang and Masra Latjompoh.; visualization, Margaretha Solang, Masra Latjompoh and Windy Oktaviani.; writing – original draft, Windy Oktaviani.; writing – review & editing, Margaretha Solang and Masra Latjompoh. All authors have read and agreed to the published version of manuscript.

Conflicts of Interest
The authors declare no conflict of interest

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